THE CHEMIST

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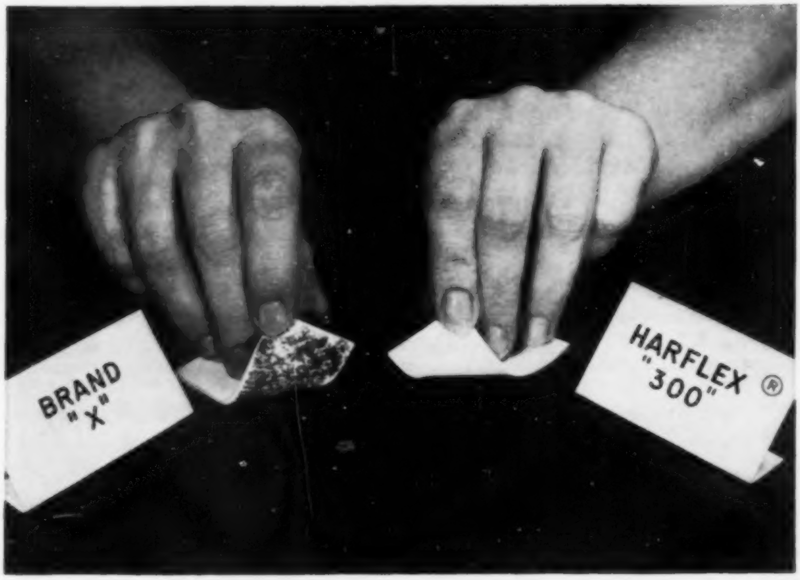
VOLUME XXXIV NUMBER 12

Maurice C. Taylor *(second from right) accepts Honor Scroll from Dr. M. H. Fleysher, chairman of the Niagara AIC Chapter. At left, M. R. Bhagwat and Dr. P. H. Margulies. At center, C. A. Weltman. At far right, Ray F. Seifert.*

(See Page 447)

Merrie Christmas



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The CHEMIST

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Volume XXXIV December, 1957 Number 12

Deadlines for *The Chemist*

Copy for the February issue of The Chemist should be in our hands before January 10th. Advertising copy for February should be received not later than January 15th.

IN THIS ISSUE

TO COME IN JANUARY

At the New Year, resolutions for personal improvement are often made. If you are ambitious and want to be more creative (a key to many doors of personal advancement), Dr. M. J. Kelley will be of help in Part III of the series, "Understanding the Creative Process." If your business needs new ideas, read "Some Practical Aspects of the Brainstorming Technique," by John H. Schneider of Abbott Laboratories. Should you be approaching retirement, consider "After Retirement—What?", an interview with two chemists who chose contrasting solutions. • The award of Honorary AIC membership to Dr. A. O. Beckman, president, Beckman Instruments, Inc., will be featured.

Recommended Suppliers and Services

EDITORIALS

For Scientists: Recognition

AFTER the scientists of the U.S.S.R. launched satellites, a dramatic event that literally placed new stars in the sky, the public sought to know how these things might affect our security, and what scientists of the U. S. were doing on our own satellite program.

Consequently, President Eisenhower created a new government position, that of Scientific Advisor to the President, to which he appointed Dr. James R. Killian, the president of Massachusetts Institute of Technology.

Then President Eisenhower spoke to the nation about the importance of scientific education, and so gave to the public a message which scientists have tried to convey for several years.

While scientists seek from the circling satellites great new knowledge about the universe, other people, inspired by "Sputniks", are discovering scientists.

Satellite Rocket Path

Photo of third stage rocket of Sputnik I passing through the constellation of Gemini, taken at 6:00 a.m. EDST, Oct. 16, at Union, Conn., with Speed Graphic camera. Exposure: 3 sec. at f/4.7, on Royal X Pan (Eastman) film. This picture was taken in the course of work done jointly by the Air Force and Arthur D. Little, Inc., to determine the altitude and velocity of the Sputnik.

Future Scientists and Citizens

Dr. John J. Bohrer, F.A.I.C.

Assistant Director of Research, International Resistance Co., 401 *N. Broad St., Philadelphia* 8, *Pa.*

(The AIC Chapters annually award Student Medals to senior college students in recognition of potential advancement of chemistry or chemical engineering as a profession.)

IT IS indeed a privilege for THE AMERICAN INSTITUTE OF CHEMISTS to recognize and reward scholastic achievements. To appreciate the magnitude of this event requires some contemplation. An initial reaction

might be, "Here are some good seniors being given medals." But think for a moment. Represented among our student medalists are many major colleges and universities, and as these representatives are the top students in chemistry, these people are going to be, must be, within the group of the nation's top scientists in the next decade or two.

Chemistry is a field in which the contribution of individuals is enormous. While it is true that today's industrial research is to a large extent a team effort, the major contributions both industrially and in basic science are made by individuals. It is from these students whom we recognize that we can expect some of these contributions.

This, however, is not all that we should expect from these people destined to be among the tops in their fields. In today's society, the scientist must assume greater responsibility for the ever increasing influence of his work on world events. He cannot set himself aside from the implications of his findings. We should expect these young people, therefore, to be among our leading citizens as well as our leading scientists.

(The students who received medals in 1957 are introduced on page 460).

Special AIC Announcements

To AIC Members

As soon as you receive the card requesting information for our new directory of membership, please fill it out and return it promptly. This will assist us in making the directory as accurate as possible.

New Chapter Publication

The Twin City Chapter began publication, in October, of *Fumes*, a newsletter edited by Rosemary Klinkenberg, M.A.I.C., of Twin City Testing & Engineering Laboratories, Inc., St. Paul, Minn. In addition to announcements, the first issue carried the current membership of the Chapter. Other Chapters which publish newsletters are Chicago, New York and Washington.

Winner Announced

The Committee on Student Medals announces that the paper on "Chemistry as a Profession", written by Thomas A. Manuel of Austin, Texas, has been unanimously chosen as the best essay submitted in the Student Medalist Manuscript Contest. Read it on page 457.

Will You Come

Dec. 3, 1957. Niagara Chapter. Meeting. Speaker, F. R. Sheldon, "Application of Statistical Analysis to Problems of Research, Production, and Management."

Dec. 5, 1957. Alabama Chapter. Huntsville, Alabama. National speaker expected. For information: Martin B. Williams, 402 Holmes St., Huntsville, Alabama.

Dec. 10, 1957. Washington Chapter. Luncheon and meeting. 12:15 noon. O'Donnell's Sea Grill, 1223 "E" St., N. W., Washington, D. C. Speaker: Dr. Lewis L. Butz, Head, Chemistry Branch, Office of Naval Research. Subject: "The Functions and Operation of the Office of Naval Research."

Dec. 12, 1957. New York Chapter. Presentation of Honorary AIC Membership to Dr. W. E. Hanford. Place: West Ballroom, Commodore Hotel, New York, N. Y. Reception, sponsored by Olin Mathieson Chemical Corporation, 6 p.m. Dinner 7 p.m. Presiding: Dr. Ernest I. Becker. Honorary Chairman, Dr. Roger Adams. Speakers: Donald E. Sargent, General Electric Co., "Dr. Hanford's Technical Side;" Richard S. Schreiber, Upjohn Co., "The Personal Side of Dr. Hanford." Presentation of Certificate: Dr. Henry B. Hass. For reservations: (Dinner $7.00—at door $7.50) Fortuno de Angelis, Foster D Snell, Inc., 29 W. 15th St., New York 11, N. Y.

Dec. 17, 1957. AIC National Council and Board of Directors Meeting, The Chemists' Club, 52 E. 41st St., New York 17, N. Y. Board meets at 5:30 p.m.; Council at 6:00 p.m.

Jan. 7, 1958. New Jersey Chapter. Meeting. Dinner 6:30 p.m. Military Park Hotel, Newark, N. J. Symposium: "Management—Technical Employee Relationships." Management's views will be presented by: Dr. William H. Lycan (Johnson & Johnson); Dr. Stanley O. Morgan (Bell Telephone Labs.), and Dr. Max Tishler (Merck & Co., Inc.) Presenting the viewpoint of Technical Personnel: Paul O. Blackmore (Interchemical Corp.); Dr. H. Herbert Fox (Hoffman-La Roche, Inc.), and Albert Gessler (Esso Research Labs.) Moderator: Dr. Allan R. A. Beeber of Keuffel & Esser Co. For dinner reservations ($4.25): Dr. J. F. Mahoney, Merck & Co., Inc., Rahway, N. J. Telephone: FUlton 8-1200, Ext. 3254.

Jan. 9, 1958. Pennsylvania Chapter. Dinner and Meeting, Penn Sherwood Hotel, Philadelphia, Pa. Award of Honor Scroll to Dr. Glenn E. Ullyot, F.A.I.C., of Smith, Kline and French. Dr. Richard T. Arnold of Alfred P. Sloan Foundation, will introduce Dr. Ullyot, who will speak on "Development and Requirements of Creativity." For information, Dr. T. M. Immediata, International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa.

Feb. 4, 1958. Niagara Chapter meeting. Details to be announced.

Feb. 7, 1958. New York Chapter. Joint meeting with American Chemical Society. Details to be announced.

Feb. 18, 1958. AIC Board of Directors and National Council Meeting, The Chemists' Club, 52 E. 41st St., New York 17, N. Y. Board meets at 5:30 p.m.; Council at 6:00 p.m.

Mar. 6, 1958. Twin City Chapter will be host at a joint meeting with the American Chemical Society, American Institute of Chemical Engineers, and Industrial Chemists' Forum. Dr. Otto Eisenschiml, F.A.I.C., Scientific Oil Compounding Co., Chicago, Ill., will speak on "Present Day Problems of Our Profession." Details to be announced.

Mar. 11, 1958. New Jersey Chapter. Visit to Anheuser-Busch Brewery. Details to be announced.

Apr. 1, 1958. Niagara Chapter meeting. Details to be announced.

Apr. 3, 1958. New York Chapter. Young Chemists Meeting. Details to be announced.

April 10-11, 1958. Thirty-fifth Annual Meeting. THE AMERICAN INSTITUTE OF CHEMISTS. Ambassador Hotel, Los Angeles, California. Host: The Western Chapter.

May 13, 1958. New Jersey Chapter. Honor Scroll Meeting. Program to be announced.

June 3, 1958. Niagara Chapter Meeting. Details to be announced.

June 4, 1958. New York Chapter. Annual Dinner Meeting and Honor Scroll Award. Details to be announced.

The Chemical Prospector

Maurice C. Taylor, F.A.I.C.

Chemical Consultant, 3040 DeLancey Road, Niagara Falls, New York

(Presented when the author received the Honor Scroll of the Niagara AIC Chapter, October 29, 1957, at the Red Coach Inn, Niagara Falls, N. Y.)

MUCH of the profit of chemical industry results from products and processes first used within the last decade. The ability of a corporation to make a profit by the development of new products is a reliable indicator of the future importance of that corporation. This value of research to industry has led to a whirlpool of suggestions, rules, and formulas for obtaining these profits from new developments.

But as one follows the directions back toward the origin of these new things, the recipes become increasingly vague until almost no one will tell how to find a promising project to develop. This situation is well set forth by Charles L. Fleming, Esso Research & Engineering Co., Linden, N. J. (C & EN, Aug. 12, 1957, p. 51), who says:

> Management can, if it wants to, order a research man to have an idea on a certain subject, but in the long run it really won't do the research management very much good to issue such an order. About all that the research management can do is to describe the problem to the research group, to inspire the group or the individual research scientist, to tell the group or the man that you are sure that he can do it, to put him together with others in the same fix, and to give him the facilities and help that he needs.

Searching for a profitable new project is much like prospecting for valuable mineral deposits. Instead of mountains of rock, one is faced with mountains of recorded science and technology. Instead of a pick and shovel, one has a laboratory and a salary. Instead of looking for ore outcroppings and color stained rocks, one reads the original record—for what it says and what it only hints at. Many people see the mountains and know their shape, but few search the hidden valleys where lies the promise of unknown riches beneath. If a prospector searches where many others are working, his chances are less and his skill must be greater. But if he goes apart, he must follow the weakest of clues, just plain hunch. Often the prospector evaluates rock samples. So too the chemical prospector carries out experiments which can give an objective answer about possible success. This analogy has its limits, but it is helpful in reaching some general rules of chemical prospecting:

1. Search areas which are not well known. (Chemistry of the transition elements Ti, Zn, Nb, Cr, Mn. Ion exchange—resins—zeolites. Low temp. Si org. in 1935—Kipping.)

2. Stay away from the center of the crowd, searching from the fringe outward. (Glycol, 1920; good 1940. Not apt to yield now.)

3. Read *Chemical Abstracts* and original articles. Chemical news magazines seldom furnish ideas useful to the prospector because, by the time

the item reaches such media, the "claim" has already been "staked out." But these magazines must be read in order to find out what others are doing.

4. Use the crucial experiment constantly. The molecules have a way of quickly and correctly combining all factors and exposing faulty thinking.

5. Use simple experimental tools if possible, so as not to get diverted from the search into a beautiful but worthless pleasure dome of fancy equipment. (Sometimes complications are necessary.)

6. Apply constantly the economic yard stick. Assume success of the project and see if it would then be profitable.

7. Project all searches onto the background of economic needs. (Inventions wanted by the Armed Services.)

8. Be ready to enter new areas and learn the scientific terrain as rapidly as possible. (Do not be a specialist.)

9. Pay attention to areas where techniques and know-how are needed. (Hydrazine.)

So the art of chemical prospecting involves reading; thinking in order to devise the crucial experiments to test the soundness of ideas, and experimentation in a laboratory where apparatus may be quickly assembled. It is helpful to be able to get straight answers to the searchers' questions on company policy and to be told when the company has an interest in any new product; also to be able to travel when the search indicates, and to keep the laboratory equipped with simple equipment and a few assistants as the work requires.

Decisions involving scientific principles, market situations, customer acceptance, company policy, production difficulties, raw material supply, patent position, and other matters have to be made at high speed. Usually these decisions are not considered a part of prospecting work but good prospecting must involve them. Calling in specialists on these matters, except in the most promising cases, is apt to slow the action and kill creativity. Better an occasional wrong answer than no creativity. A chemical prospector needs broad experience.

Matters not essential to the search are conferences, persuading, report writing, advising other departments, personnel problems and even the personality of the searcher. These things are important but are secondary to finding a new product or process. This may seem like the "ivory tower" treatment to the corporation management, but it will not be so to the experienced chemical prospector.

Among the psychological processes of invention, the step of "illumination" is the heart of the matter. Here the processes of the subconscious are involved—that netherland which Freud most clearly described; which we all have but cannot perceive; which is capable of operating more independently of our emotions than is the conscious, and hence is more free of prejudice and the foibles of prior experience. The problem is how to discover the conclusions of the subconscious. For some they may persist in the first hours of wakening when a sound solution to a perplexing

problem appears without effort. For others, it may be the hunch while shaving. There is no pat formula. Probably anxiety, fear, and hate interfere, while peace of mind, strong motivation, and calm surroundings help.

This is a sketchy picture of the chemical prospector's approach to his work. It is a life that may have great satisfactions or great frustrations. It is not without glamour. I like the words of the anonymous prayer:

> "Give thy servant the eyes of the eagle and the wisdom of the owl; Connect his soul with the gospel telephone of the central skies; anoint him all over with the oil of thy salvation and set him on fire."

Now consider the industrial structure in which the chemical prospector operates. For success there are two important requirements:

1. Motivation. Eventually, material rewards in case of success.

2. Control of his operations.

Corporations seem to have great difficulty in meeting these requirements adequately. Most chemical prospecting is performed in the framework of a research and development department. Two thirds of this department is often composed of nontechnical personnel, including mechanics, laboratory assistants, operators and clerks. Two thirds of the technical personnel are in development and engineering work. A part of the remaining 11% includes the chemical prospectors. Though the group is small, it is of great importance since it determines what the corporation will be working on in the future. Great ability, active imagination, and real creativeness can be most effective if present in this group. Research management should provide freedom of action and adequate rewards for these men. The job is more difficult than management and may well be more highly rewarded when successful. Such recognition would at least slow down the movement of the best scientific talent into administration work, where there is no time for scientific creativity. Good research administration is important, but its objectives of personnel selection, good interpersonal relations, provision of facilities and communications channels, proper correlation and cooperation are secondary to the job of finding the promising products and processes.

Many schemes have been proposed whereby the individual may be promoted along professional lines, without having to undertake extensive administration work. Du Pont and Cyanamid have such structures. This is a step in the right direction, if the promotions can be based on accomplishment and if the top salaries are flexible. The present fashion is to make promotions by using employee evaluation techniques which lean heavily on psychological factors. Psychology is important, but much of the time in industry it is applied by people poorly trained in its intricacies.

The typical conception of a modern research establishment pictures a group of highly trained individuals, provided with much complicated equipment, all housed in an imposingly designed edifice. Since the expense of such a unit is tremendous, the popular idea is that the higher the cost the more valuable the results. Conversely, if results are not forthcoming, it is supposed that the difficulty can be overcome by pouring more money and men into the effort; whereupon useful results are supposed to emerge as by magic. This is dangerously misleading. The limiting factor in research is usually not men and money, but the ability, skill, and imagination of the individuals involved. Basic inventions and discoveries are still usually made by individuals and not by "teams", though teams fit in better with corporate organizations. As examples of individual work, consider Ziegler on polyethylene, Reppe on acetylene, Schlesinger on organic boron compounds, Miller and E. O. Fischer on the ferrocene type bond, Carothers on nylon, Banting and Best on insulin, Fleming on penicillin, Franz Fischer on synthetic fuels. Once the field has been exposed, the team is then effective because of the volume of experimentation indicated. . . . But for initial prospecting, group oriented research is ineffective and expensive compared to an environment favorable to the individual.

As a corollary to this ineffectual emphasis on group research, there is the profession of research management. This is the goal of most men entering research because it is the established route of promotion. Rather, the goal should be scientific competence and accomplishment in terms of discovery and invention. These are the results desired. They come more often from a good organization; but whether the organization is good or bad is secondary to the attainment of scientific advances. A good organization that does not produce valuable results is worthless except for social purposes.

In the modern technical estate, administrative work carries greater rewards, prestige, and honor than being a scientist. The typical corporate management through its financial structure retains control of its scientists. This control is exercised to involve decisions on scientific matters by those who have little knowledge of the subjects involved. Should research produce developments in areas which conflict with policies or decisions, it is difficult to follow up these discoveries despite the scientific implications. From the standpoint of both society

and the technical profession, it is questionable if a corporation as now typically constituted is qualified to make these decisions affecting the course of scientific development.

In some way, corporate management must find a way to increase the quality of their decisions in the scientific field. Presumably this will involve an elevation of the status of their career scientists. That the humble scientist should be so important is, perhaps, the great industrial paradox of our time.

Introduction to Maurice Craig Taylor

M. R. Bhagwat, F.A.I.C.

Chemical Engineer, Hooker Electrochemical Co., Niagara Falls, N. Y.

(Presented when Mr. Taylor received the Honor Scroll of the Niagara AIC Chapter, Oct. 29, 1957, at Niagara Falls, N. Y.)

MAURICE CRAIG TAYLOR was born, Feb. 28, 1894, in Lima (now Howe), Indiana. He had a natural aptitude for general science and chemistry as these were his preferred subjects of interest in the local high school. An unusual event may have started him on his career in chemistry. It occurred when his high school chemistry teacher and the class were gathered around a table for a demonstration involving the properties of metallic sodium. Somehow the metal came in contact with water and the result was a spectacular flash! He was, no doubt, fascinated with the unsuspected possibilities of chemistry!

He was also influenced by his mother's fondness for music. His great-great-grandfather had played a cello, which had been in the family since 1820. Young Maurice, therefore, decided to take up cello playing, which he learned under Prof. Zumpfe, becoming quite proficient before he graduated from high school in 1911. Later on, he found this was a most helpful accomplishment.

He then attended Winona College, Winona Lake, Indiana, where he secured a license for teaching in the public schools. His first teaching experience was in a one-room school with thirty students, from the first to the eighth grade. Supplementary to his teaching assignment, he tended a coal-burning stove and played the school organ. During the two years he was a teacher, he was frequently invited to play incidental music at social gatherings and hotel dining rooms, and these earnings enabled him to save money for starting expenses at college. But then his parents decided to move to Los Angeles, California. This was the first time Maurice saw a big city. Here he played cello music in cafes and motion picture theatres, saving enough money to enter Purdue University, Lafayette, Ind., in the fall of 1914.

Freshman Taylor specialized in agricultural chemistry but took all of the chemistry courses given at the college. During these four years he earned the money he needed by cello playing. He received the B. S. degree in 1918, and was promptly drafted into World War I. He felt he could be more useful to his country through his chemical knowledge than by serving in the trenches; hence he managed to secure assignment into the Ordnance Department at Edgewood Filling Station, Edgewood, Md. (now Edgewood Arsenal.) His work turned out to be the job of filling shells with poison gas.

Later, he was one of the four candidates selected for chemical work at Ohio State University. The project involved the determination of physical constants of war gases, to be used in designing equipment for the manufacture of chloro-picrin, and other gases. He was highly commended for developing the technique for distillation and purification of mustard gas, and was the first of the group to be commissioned. He also attended post graduate classes in chemistry, particularly physical chemistry under Prof. Hall.

Col. Charles F. Vaughn, general manager of Mathieson Alkali Works, Niagara Falls, N. Y., was head of the Chlorine Division of the Chemical Warfare Service at Ohio State University. After the Armistice, when the army work at Ohio State was stopped, Col. Vaughn recommended Maurice to the Mathieson Research Department. This resulted in an offer from Mathieson of a salary of $167 per month. Maurice had also received another offer, to teach at the University of Kansas at $150 per month. However, this difference of $17.00 was the deciding factor, and Maurice accepted the position as research chemist with Mathieson in January, 1919. He had married, just three months before, Elmina Louthan, a graduate of Purdue, who taught music and who had played in the same orchestra with him. So they moved to Niagara Falls, where they still live. They have three children, one daughter and two sons.

Maurice was associated with Mathieson Alkali Works, later known as Mathieson Chemical Corporation, from 1919 to 1949. He was the principal administrator at the Niagara Research Laboratory for nearly 25 years. He held the following positions: 1919-1924, research chemist; 1925-1930, chief research chemist; 1931-1941, assistant director of research; 1941-1945, manager of research, and 1945-1949, resident director of research and development. Though receiving his assignments (except for the latter few years) from Ralph Gage, technical director, he was permitted to work quite independently. Under his direction, a wide range of industrial chemical research projects were investigated, cov-

ering inorganic salts, organic silicon compounds, corrosion inhibitors, dichloro-styrene and elastomers, quaternary ammonium compounds, insecticides, solvents. The major research projects led to the production of chlorites, hypochlorites, hydrazine. Many improvements were made in the economic operation of the mercury cell for the manufacture of caustic soda and chlorine. He was often consulted on process problems involving the ammonia soda operations at Saltville, Virginia, and Lake Charles, La. He has a commendable list of publications and patents.

Since 1949, Maurice has been owner and director of Taylor Research Laboratories, chemical consultants. He is presently engaged in sponsored experimental work and as chemical consultant. From 1952 to 1957, he was associate in industrial chemistry at the University of Buffalo.

Maurice and Elmina have continued their interest in music and both have been active members, since 1922, of the Niagara Falls Philharmonic Orchestra. They are members of the Shakespeare Symposium. They also enjoy archery and ice-skating.

Maurice is a Fellow of THE AMERICAN INSTITUTE OF CHEMISTS and a member of the American Chemical Society, the Electrochemical Society, The Chemical Society (London), Sigma Xi, and Phi Lambda Upsilon. He is past chairman of the Niagara AIC Chapter and of the American Chemical Society Section.

Now you have the background of the man I first met during the summer of 1924, when I visited the chemical industry at Niagara Falls. I shall always remember his cordial welcome to me at the Mathieson plant. I was interested in the technology of cellulose production for use in the paper and rayon industries, because I had planned to return to India, after completing post-graduate studies to develop such industries there. Maurice spent much time explaining to me the steps involved in the economic operation of the caustic-chlorine cells, particularly the mercury cell.

Circumstances changed for me, and I stayed in the United States. Nearly twenty years passed before I met Maurice again. This time I came to Niagara Falls to see him about a position on the research staff of Mathieson Alkali Works. I was again impressed by his sincere and sympathetic consideration. In April, 1942, I became one of the research staff. Maurice was then manager of the Research and Development Department. Every day several from our small technical and laboratory staff, including Maurice, had our lunch in the library room. This was the most entertaining hour of the day. We discussed all sorts of subjects, technical and non-technical, from the structure of the universe to local politics. Here I was among men of diversified interests.

To me, Maurice was an example of genuine simplicity. He spent long

hours at his desk in a small office furnished with the most inexpensive equipment. He impressed upon me the value of pertinent details to complete the evaluation of experimental programs. He gave opportunity for independent thinking yet guided the research program to its objectives. He preferred to run a few crucial, simple experiments to find the answers. He always found time to give me an opportunity to discuss the research program, then he would usually say, "This is the way I feel you should run the experiment but I want you to do it your way first and see which is the better procedure to use."

As the research group was enlarged, I sometimes only saw Maurice during the lunch hour. Because of the limited laboratory space, it was my pleasure and at times, inconvenience to work in a little laboratory which was reserved for him, just behind his office. Each time I had to go in or out, I had to go through his office! I do not know what the many executives in conference with him thought, when I quietly opened the door of the laboratory and walked through! Quite often, Maurice worked after hours on some experimental technique which he had been thinking about. His favorite instrument was the microscope which he used in identifying chemical compounds. We worked together for many hours and I recall that the last few experiments we were running gave successful results in the evaluation of certain salts of hydrazine.

All the members of the staff unanimously concurred that they felt quite at home with Maurice and seldom considered him as "the big boss." Like his cello playing, his thinking is precise, well founded, and purposeful.

I first heard Maurice playing the cello at one of the local churches and was quite impressed by his magnificent performance. Since then, I have attended many concerts of the Niagara Falls Philharmonic Orchestra with which he is associated as the first cello player.

Maurice was one of the founders of the Niagara AIC Chapter. In 1942, he was elected its chairman. As secretary of the Chapter that year, I was impressed with his enthusiasm and devotion to this professional group, an interest he still maintains, as is shown when he said, "Informal friendly spirit and good fellowship have prevailed throughout the thirty years since the establishment of this chapter. In fact this group is outstanding among technical groups for its fine interpersonal relations. I hope that more young chemists will find this out so that the spirit of good comradeship will be preserved."

When I think of Maurice and his leadership among men, I am reminded that:

> "We walk the path the great have trod,
> The great of heart, the great of mind,
> Who looked through Nature up to God
> And looked through God to all mankind."

Presentation To Mr. Taylor

Maurice C. Taylor

THE Niagara Chapter of THE AMERICAN INSTITUTE OF CHEMISTS presented its Honor Scroll to Maurice C. Taylor, owner of Taylor Research Laboratories, 3040 DeLancey Road, Niagara Falls, N. Y., at a dinner meeting held October 29, 1957, at the Red Coach Inn, Niagara Falls, N. Y.

Dr. Maurice H. Fleysher, chairman of the Chapter, and senior research chemist, National Aniline Division, Allied Chemical & Dye Corporation, presided and presented the Honor Scroll.

M. R. Bhagwat, chemical engineer, Hooker Electrochemical Company, spoke on Mr. Taylor's career and service in organizing and supporting the Chapter, as well as his significant contributions to the Niagara Frontier chemical industry.

Mr. Taylor accepted the scroll with an address on "The Chemical Prospector." (These papers appear on preceding pages.)

The citation on the Honor Scroll reads:

To

Maurice Craig Taylor

A Charter Member of the Chapter, an active and indefatigable worker for many years, a capable man of fine character who holds our deepest affection and esteem. For these human qualities and for his many contributions to the electrochemical art, we do him honor.

Pittsburgh Conference: On Analytical Chemistry and Applied Spectroscopy will be held at the Penn-Sheraton Hotel, Pittsburgh, Pa., March 3-7, 1958. It is sponsored by the Analytical Chemistry Group of the Pittsburgh Section of the American Chemical Society and the Spectroscopy Society of Pittsburgh.

Changed: The address of Gutberlet Laboratories to 4106 Airport Way, Seattle 8, Washington. Owner of the laboratories is **E. L. Gutberlet,** F.A.I.C.

Coming Meetings: Of the American Association for the Advancement of Science will be held: Dec. 26-31, 1957 at Indianapolis, Ind.; Dec. 26-31, 1958, at Washington, D. C.; Dec. 26-31, 1959, at Denver or Cleveland, and Dec 26-31, 1960, at Philadelphia, Pa.

Advanced Statistical Methods Course: Offered by the Chemical Division of the American Society for Quality Control, at Harvard Business School, Jan. 12-23, 1958. For information: Richard S. Bingham, Jr. (SMPD), The Carborundum Co., Research & Development Div., P. O. Box 337, Niagara Falls, N. Y.

Changed: The Corporate name of Food Research Labs., Inc., to Food and Drug Research Laboratories, Inc., which have been moved to larger quarters at Maurice Ave., and 58th St., Maspeth, New York. **Dr. Bernard L. Oser,** F.A.I.C., is director.

New Distributing Center: Now being erected by Becco Chemical Division of Food Machinery & Chemical Corporation in Framingham, Mass.

Change of Name: From National Distillers Products Corp., to National Distillers & Chemical Corporation, at 99 Park Ave., New York 16, N. Y.

New Laboratory: Opened by Bjorksten Research Labs. of Madison, Wisconsin, at 2405 Norfolk St., Houston, Texas.

PRIZE PAPER

Chemistry as a Profession

Thomas A. Manuel

1202 *West 22½ St., Austin 5, Texas*

(This paper was chosen by unanimous vote of the Committee on Student Medals as the best essay submitted in the Student Medalist Manuscript Contest of 1957. The prize was $100.00. The author received a student medal from the Ohio Chapter last Spring, when he was a senior at Ohio Wesleyan University.)

A PROFESSION has been defined as "an occupation requiring a liberal education . . . and mental rather than manual labor." The art or science of chemistry, however the textbook or freshman course definition may read, broadly meets these requirements. Chemistry is indeed a profession, an expanding, vital part of modern society. But the purpose of this essay is not to expound upon the place of chemistry in the economy, nor upon the importance of this or other sciences to material progress. The perspective is to be an internal one, exploring those factors within chemistry, *per se*, and the profession thereof, which attract talented people to its study and practice.

The motives behind a person's choice of life work are diverse, but from this diversity two broad groups of reasons may be separated, the first group dealing with the nature of the work itself, and the second concerning externals, such as financial compensation and professional prestige. To the person who chooses to make chemistry his vocation, the former will be predominant.

This is, however, not to deny the security and the economic advantages offered by a career in chemistry. The demand for scientists and engineers, the competition for graduates, and the excellent salaries offered to inexperienced personnel are all too well tabulated in a host of articles and reports to be enumerated again here. Chemists live well enough, but rarely become wealthy from their profession. The upper-middle income brackets are often attained by chemists, but to the man whose real motive is the accumulation of money and the earning of a large salary, chemistry would prove a disappointment. One must seek a deeper ambition, than financial gain, in the skilled and talented men who call themselves chemists.

Although enjoying respectability as a "professional man" the chemist is often considered to be just a little more pedestrian than the doctor or lawyer. The taint of working with hands, as well as the suspicion of eccentricity, still clings to the chemist, and his position is not one of outstanding prestige in the eyes of the mass of people. Therefore, it is not for power or universal adulation that one turns to chemistry.

What then, are the real satisfactions that accrue to the chemist, and

from what do they stem? The actual acts of manipulation and the manual labor of assembling and operating a reactor or a complex system for measuring some subtle property of a substance can be thrilling. Becoming a builder, the chemist experiences the pride of an artisan in the proper functioning of his handiwork. Working with the hands thus becomes one of the pleasant aspects of chemistry, calling to the man with an urge to tinker and to construct.

The profession of chemistry is as exciting an occupation as man has yet devised. It has become a truism that today's frontiers lie in the laboratory. The continents yet to be penetrated and exploited are those of knowledge, and many of the depths yet to be plumbed are to be found within the reaction flask. Laboring forever on the edge of discovery, the research chemist strives to illuminate better some small part of man's environment. And always before the chemist is the lure of the unknown, spurring him to further inquiry.

The science of chemistry deals with the properties of matter itself, seeking information among the fundamental building blocks of common objects. From macroscopic production to elucidation of processes in microscopic terms, the chemist deals in basic things. The privilege of approaching so closely the ultimate is common to relatively few professions.

There is a fine fascination about the intricacies of matter and the unending complexity of the world. The study of the chemist is a gripping one, in which fragments of information must be accumulated, until it becomes possible to systematize and organize, bringing hitherto isolated parts together in an organic whole. The gratifying, rigid empiricism of the process of data collection leads to meaning only when coupled with an imagination capable of seeing the connections between facts. Thus chemistry satisfies the pragmatic mind, while providing unlimited room for the play of ideas and imagination.

In production as well as in research are to be found satisfactions for the chemist. The molding of raw materials into useful products is inherently intriguing, and the chemist can see his work bear tangible fruit, as laboratory work grows into commercial products and processes. Feeling himself a real contributor to the expansion of material well-being, as well as to the store of knowledge, which has its peculiar intrinsic value, the chemist knows that his work yields progress. It is not too idealistic for one to take pride in his profession as it assists in the growth and advancement of society.

Thus may be scantily expressed a few of the attractions of chemistry, but with these privileges comes serious responsibilities. Let us turn from the enciting aspects of chemistry as a profession to the duties resting upon its practitioners. As any scientist does, the chemist owes primary allegiance to

truth and the honest pursuit of it. Intellectual integrity must be paramount, but responsibility does not end at the door of the laboratory.

The member of a scientific community today cannot limit his interests and activities to his own esoteric specialty, but must remember that he is a part of his community and nation. As many of the problems confronting the body politic have their origins in technological change, the duties of citizenship should be felt especially keenly by scientists. The chemist has helped to create the dynamic world of today, and he must feel the obligation to help men learn to live in this world.

Extending well beyond the publication or commercial realization of his work, the chemist's concern must reach to the impact of his developments upon the lives of others. Interpretation of a world based on science must become to a great extent the task of scientists, or others applying the scientific method to the problems of human behavior.

Never very practical, the ivory tower approach to science has become dangerous. It is the duty of scientists to become alert, informed citizens, willing to serve the community in ways other than those of the laboratory or production facility. The comic stereotype of the absent-minded, withdrawn chemist must be given a firm rebuttal in the intelligent conduct of chemists as citizens.

Chemistry as a profession, then, possesses attractions and corollary responsibilities. It furnishes a challenge for both the mind and the hands. Intellectual as well as physical satisfaction is the product of the chemist's work. Variety and the thrill of exploration lend enjoyment, while the chemist can be content in the knowledge that he is making a valuable contribution to the progress of society. The challenge, the responsibility, and the intrinsic fascination of chemistry can be matched by few other professions.

Changed: The name of the Colorado Agricultural & Mechanical College to Colorado State University, Fort Collins, Colorado.

Change of Address: For Schaar & Co., to 7300 Montrose Ave., Chicago 34, Ill.

Student Medalists of 1957

NAME	COLLEGE	AIC CHAPTER WHICH MADE THE AWARD
Abramson, Marc F.	Haverford College	Pennsylvania
Albertz, Mary J.	College of Mt. St. Joseph-on-the-Ohio	Ohio
Badding, Victor	Canisius College	Niagara
Barry, Henry M.	New York University	New York
Bass, David	Boston University	New England
Beede, Charles H.	Northeastern University	New England
Bentrude, Wesley G.	Iowa State College	Chicago
Berkowitz, Leonard	Polytechnic Institute of Brooklyn	New York
Berndt, Donald C.	Ohio State University	Ohio
Bisbee, Warren	Whittier College	Western
Borror, Alan L.	Drexel Institute of Technology	Pennsylvania
Boudreau, Robert J.	Fordham University	New York
Boyd, Garland, Jr.	University of Mississippi	Louisiana
Brooks, Richard E.	Northeastern University	New England
Broussard, Barbara	Loyola University	Louisiana
Brown, Donald W.	Muskingum College	Ohio
Brunner, Paul A.	Cooper Union	New York
Buhrer, Carl	Polytechnic Institute of Brooklyn	New York
Burright, Leon M.	University of Wichita	Chicago
Caldwell, Vincent	Capital University	Ohio
Castellino, Loretta I.	Florida State University	Louisiana
Chang, James	Mount Union College	Ohio
Christman, Roy L.	Ohio University	Ohio
Collins, George F. Jr.	Loyola University of Los Angeles	Western
Collins, Ronald	University of Dayton	Ohio
Cooper, Edward J.	University of Arkansas	Louisiana
Cotton, Donald J.	Howard University	Washington, D. C.
Current, Jerry H.	Indiana University	Chicago
Dixon, William B.	Wheaton College	Chicago
Dugan, John V., Jr.	LaSalle College	Pennsylvania
Eaton, Philip E.	Princeton University	New Jersey
Elton, Lewis M.	Fenn College	Ohio
Fenrick, Harold W.	Beloit College	Chicago
Ferretti, Louis D.	University of Pennsylvania	Pennsylvania
Flevares, Constantine W.	University of South Dakota	Chicago
Flynn, Robert M.	Catholic University of America	Washington, D. C.
Fritz, Betty Jo	University of Kentucky	Ohio
Gaab, Frederick	Polytechnic Institute of Brooklyn	New York
Gagen, James E.	Kent State University	Ohio
Gastwirt, Larry	City College, School of Technology	New York
Gelbein, Abraham P.	Cooper Union	New York
Gillen, Mary Ann	Chestnut Hill College	Pennsylvania
Goldberg, Edward	New York University	New York
Goldschmidt, Bernard	City College	New York
Gueritey, Patricia R.	Douglass College	New Jersey
Gwinup, Paul	Oklahoma A. & M. College	Louisiana
Hammond, Lynnettee	Philadelphia College of Pharmacy & Science	Pennsylvania
Hansen, Holger V.	Lehigh University	Pennsylvania
Hathaway, Chester D.	Miami University	Ohio
Hauk, Rosalind	George Washington University	Washington

Helminiak, Thaddeus	John Carroll University	Ohio
Helms, Jon D.	Ohio State University	Ohio
Herbert, Joyce	University of Buffalo	Niagara
Hering, Burton	New York University	New York
Hidy, George	Columbia University	New York
Himes, Glenn R.	George Pepperdine College	Western
Hobey, William D.	Tufts University	New England
Hodgkins, Nancy	Simmons College	New England
Hosler, Earl R.	University of Dayton	Ohio
Ifft, James B.	Pennsylvania State University	Pennsylvania
Jacobs, Gerald	Bowling Green State University	Ohio
Johnson, James W.	School of Mines and Metallurgy	Chicago
Johnson, Quintin C.	St. Olaf College	Chicago
Jones, Joseph S.	Kansas State College	Chicago
Jordan, Peter C. H.	California Institute of Technology	Western
Josephic, David J.	Xavier University	Ohio
Keenan, John R.	College of St. Thomas	Chicago
Kertesz, Denis J.	Northwestern University	Chicago
Kiefer, Edgar F.	Stanford University	Ohio
Killmeier, Charles T.	University of Louisville	Ohio
King, Donald M.	State College of Washington	Western
King, Jennifer	Denison University	Ohio
Koenig, Robert G.	University of Cincinnati	Ohio
Krapp, Paul J.	University of Notre Dame	Chicago
Kust, Roger N.	Purdue University	Chicago
Larson, Jane	University of Minnesota	Chicago
Levin, Ira W.	University of Virginia	Washington, D. C.
Lingrel, Jerry B.	Otterbein College	Ohio
Linzer, Melvin	Brooklyn College	New York
Ludwig, Oliver G.	Villanova College	Pennsylvania
MacLeay, Ronald E.	St. Bonaventure University	Niagara
Manuel, Thomas A.	Ohio Wesleyan University	Ohio
Marsh, Constance E.	Vanderbilt University	Ohio
Maselli, James M.	Lafayette College	Pennsylvania
Mersol, Irene	Ursuline College for Women	Ohio
Mitchell, Charles D.	Monmouth College	Chicago
Montana, Victoria M.	Immaculate Heart College	Western
Mumma, Richard H.	University of Delaware	Pennsylvania
Nawn, George H.	Boston College	New England
Nilsson, William A.	University of Illinois	Chicago
Noelken, Milton E.	Washington University	Chicago
Palen, Joseph W.	University of Missouri	Chicago
Parker, James L., Jr.	Lawrence College	Chicago
Partyka, Richard A.	De Paul University	Chicago
Plourde, Gail R.	Michigan State University	Chicago
Rader, Charles	University of Tennessee	Ohio
Renick, Rebecca J.	University of Chicago	Chicago
Ricci, John M.	Seton Hall University	New Jersey
Roberts, Julius, Jr.	University of Southern California	Western
Rose, Norman J.	Knox College	Chicago
Ross, Louis Alan	Loyola University	Chicago
Ryan, Leo F.	Newark College of Engineering	New Jersey
Rynder, Patricia L.	University of Toledo	Ohio
Saines, George	American University	Washington, D. C.
Schearer, William R.	Ursinus College	Pennsylvania
Schwartz, Alan W.	New York University	New York
Shankland, Ruth E.	Western Reserve University	Ohio
Sholette, William P.	St. Joseph's College	Pennsylvania

Simmons, Bill H.	Louisiana State University	Louisiana
Simon, Patricia	Lake Erie College for Women	Louisiana
Skelton, Aubrey D.	Mississippi State College	Louisiana
Sloan, Roy M.	University of Santa Clara	Western
Spang, Ardell R.	Temple University	Pennsylvania
Steigelmann, Edward F.	University of Wisconsin	Chicago
Stenger, Robert A.	University of Michigan	Chicago
Stevens, Nicholas J., Jr.	Massachusetts Institute of Technology	New England
Strauss, Herbert L.	Columbia University	New York
Stynes, James	Niagara University	Niagara
Talbott, Richard L.	DePauw University	Chicago
Teerlink, Wilford J.	University of Utah	Western
Temple, Ralph	Hiram College	Ohio
Thomason, Stuart H.	Occidental College	Western
Tobey, Stephen W.	Illinois Institute of Technology	Chicago
Toddy, James S.	Pomona College	Western
Tufariello, Joseph	Queens College	New York
Tunder, Richard	Case Institute of Technology	Ohio
Tusch, Robert L.	Michigan College of Mining & Technology	Chicago
Velaer, Charles A.	Roosevelt University	Chicago
Vincent, James S.	University of Redlands	Western
Viola, Victor E., Jr.	University of Kansas	Chicago
Wagner, Vernon L.	Tulane University	Louisiana
Weiss, George R.	Rutgers University	New Jersey
Whitlock, Howard W.	University of Maryland	Washington, D. C.
Wigton, Paul N.	Youngstown University	Ohio
Williams, David C.	Harvard University	New England
Williams, Kent	Baldwin Wallace College	Ohio
Wilson, Edith M.	University of Texas	Louisiana
Winn, William H.	Georgia Institute of Technology	Louisiana
Wise, Stephen S.	Oberlin College	Ohio
Wolf, Alexander	Pennsylvania Military College	Pennsylvania
Wolpers, Jurgen P.	Massachusetts Institute of Technology	New England
Yanke, Carol	Notre Dame College	Ohio
Yunker, Wayne	Oregon State College	Western
Zabriskie, A. Audrey	Wellesley College	New England

On Psychological Testing

The other day I took one of the standard psychological testing sheets used so widely now in personnel work and applied it to . . . Benjamin Franklin. Based on what we know of Franklin's character, I could only conclude that he would have had bad luck winning a place for himself today if he were judged on these standards.

One of the questions asks, "Do you daydream?" Ben, I am afraid, did. An affirmative answer would merit a poor score on the test, although Franklin's daydreams brought useful results in fields ranging from political science to stoves and bifocal spectacles.

No doubt, Charles Goodyear and Elias Howe would have been rated as impractical dreamers. Thomas Edison, with a history of insomnia and carelessness in dress, might well have been regarded by the modern personnel manager as an undesirable risk.

—Crawford H. Greenewalt, F.A.I.C.
(From *Management Review*)

Technology Or Tranquilizers

C. D. Ender

Director of Development, Naval Stores Department, Hercules Powder Company, Wilmington, Delaware

(Presented at the 1957 Student Award Dinner of the Pennsylvania AIC Chapter, Philadelphia, Pa.)

ABOUT two million days ago man added to his skills the language of technology, mathematics. He devised symbols that represented fixed quantities. He recorded these symbols and he learned to manipulate them. Two million days ago this language of numbers served man principally in his bartering of goods; in observing the movements of the sun and other heavenly bodies so he could reckon time and safely steer his ships; and in surveying the land to designate his property.

Two million days is not a long time. Expressed another way, it is about 6,000 years, which sounds like a much longer time.

If one accepts the proposition that there is a distinction between technology and art and that one of the differences is the quantitative nature of technology, then we can conclude that the birth of mathematics had to precede the birth of technology. Therefore, technology can be not more than about two million days old.

It took a long time for technology to have much of an impact on the masses of human beings. For centuries it was the private preserve of the priests of various religions, of the courts and royalty, and of scholars and merchants. Only recently has knowledge and education been democratized so that learning is accessible to all who are willing to make the effort to acquire it.

The Renaissance or Revival of Learning ushered in the period where new thoughts and ideas could flourish, an environment essential to the growth of science and technology. This took place about 150,000 days ago. It was sparked by geniuses such as Copernicus with his exposition of the solar system; Galileo with his telescope; da Vinci with his multitude of scientific inventions; and others, such as Kepler the astronomer; Boyle the chemist; Liebrietz, Huygens, Napier, all mathematicians. This was the time of discovery of the basic laws governing our universe; the establishment of a foundation of knowledge upon which future scientific discoveries could be made and a technology developed to make this knowledge serve men.

However, the growth of technology had to await the Age of Power. Seventy-five thousand days ago, practical methods were discovered which converted heat into mechanical energy. The Industrial Revolution was un-

der way. The first mechanical device was the Newcomen engine, which, strictly speaking, was an air engine actuated by atmospheric pressure when a vacuum was produced by condensing steam. James Watt modified this principle by utilizing the pressure of steam to operate a mechanism which was the grandfather of all steam engines.

The Age of Power made it possible for technology to begin serving people directly. Ships were no longer at the mercy of the wind. The steam locomotive made ground travel swift and comfortable. The production of goods was no longer solely a product of hand craftmanship nor was it dependent on water or animal power.

Steam power had one serious limitation, however. The energy it produced had to be used comparatively close to the generating source. It was about 28,000 days ago when this obstacle was removed by the practical conversion of mechanical energy to electrical energy, which could be transported over long distances. The first central steam plant for generating and distributing electricity went into operation in 1881. The practical generation of electric power from atomic fission was realized about 1,000 days ago.

My point is self-evident. The age of the earth is somewhere between three and five billion years. Man, at least in terms of a reasoning animal endowed with superior intelligence, appeared sometime within the last million years. It is only within the past 6,000 years of his existence that he has acquired some knowledge of the laws that govern all creation and, with intelligence, has guided natural forces to serve him. Of this 6,000 years, man's technology has flourished only during the last 300 years, but at a phenomenally increasing rate.

Out of this tremendous increase in technology have arisen problems, which are becoming more significant. The pace of living is increasing in tempo; environment is becoming more complicated; the occupations of men require increasing intellectual capacity. We are surrounded by all manner of gadgets and mechanisms. These technological servants impose a requirement on man, the master. He must have the capacity to control them; he must have the capacity to adjust himself to the change in environment they make possible.

There have always been people unable or unprepared to adjust to an environment. The more serious cases are called mental patients; others might be termed queer or just plain different. But statistics show that the number of mental patients is increasing at an alarming rate; one-third of the hospital beds in this country accommodate mental patients. A large part of this statistical increase may represent the recognition of mental ill health that was ignored years ago. Yet the adjustment of an individual to his environment is becoming more difficult, because of the increasing

complexity of the environment. Will the impact of our increasing technology on our everyday living make for an ever increasing amount of mental illness? Yes!

Will an environment of increasing complexity mean an increase in the portion of the population who is unable to successfully cope with it? Yes!

As a creature of creation, man's intellectual capacity will not increase at a rate much different from that of the past. The change should follow the pattern of a typical evolutionary process. The social structures that man has evolved, however, can change at a much faster pace, but no faster than man's recognition that a change is needed, and his willingness to make the change.

Though not minimizing the problem of the shortage of scientists, we must not ignore the problem of the non-scientist in a highly technological world. For every 100 children who enter the first grade of school, 20 will drop out before reaching high school. Another 21 will drop out during their high school years. Fifty-nine will graduate from high school. Thirty of these will enter college. Only 13 will graduate, and of these three will be graduated in engineering and science.

Most experts agree that the output of scientists and engineers needs only to be doubled to take care of our needs. That means 100,000 graduating engineers and scientists instead of the present 50,000. Or, if for every 100 children who enter the first grade, we can encourage 6 embryonic scientists and engineers instead of the present 3, the goal will have been achieved.

Let us assume that this goal is met. What about the other 94 people, the non-scientists and the non-engineers? How will they make out in this increasingly technological world? At present they are doing fine except for whatever number becomes mental patients because they cannot cope with their environment. In the future, things will not be so good. The man whose only skill is the use of muscles will find the number of jobs available to him on the decrease. As intellectual capacity becomes increasingly essential, the larger will be the proportion who will become dependents or public charges. The individual who might be termed marginally literate by today's standards would be the illiterate of tomorrow.

The growth of man's technology will, unfortunately, make it easier

to destroy himself in the world of tomorrow. To survive man must be more moral, more conscious of right and wrong, and more aware of his Creator than he is today. What we consider today to be an adequate awareness of the needs of our fellow man will be quite inadequate in tomorrow's world.

The solution of these problems does not lie in the use of tranquilizers, or mental institutions, or psychiatry. These are only the cures or palliatives that must be applied because the problem exists.

The elimination of the problem lies in the upgrading of man's ability to adjust himself and cope with his changing, increasingly complex world. The intellectual resources of mankind are certainly not taxed to the limit. Their development would enable man to easily keep up with his changing environment. This is primarily a problem of education, not the education of more scientists and engineers, but of more education for everybody, regardless of vocational preferences.

If, instead of the 13 out of 100 children who graduate from college, the figure can be raised to 60, we have little to worry about for the future. I picked 60, because that number in 100 children have a mental capacity equal to our present college graduates. Between 80 and 90 of these children have a mental capacity to take them through high school. We have a lot yet to do to utilize

fully the intellectual capacity of man by present day educational standards. Thus, as scientists, we have a responsibility for education that extends beyond the encouragement of more students to follow careers in science.

I mentioned before that technology has increased man's power to harm himself. I am not necessarily thinking of atomic fission. There are many everyday cases, not as dramatic, where man in the use of his technology can be a menace to himself by irresponsible acts. Driving an automobile on crowded streets is a close-at-home case. The use of modern insecticides, highly toxic but very useful materials, can be a dangerous proposition in the hands of the uninformed. The indiscriminate dumping of industrial wastes into streams or the atmosphere can be a danger to health. A simple match in careless hands can cause tremendous damage.

So, in addition to more education, there must be a greater sense of moral responsibility, a greater consciousness of right and wrong, a greater feeling of responsibility for the wel-

fare of others. These are a product of education in a broad sense, which involves the school, the home, the church or temple, the organizations such as Boy Scouts, the welfare and charitable organizations, organized recreational activities.

Scientists as a group are sometimes labelled as introverts, even anti-social. This is not a correct judgment. They are about as normal a group of people as there is. What sets them apart is their exercise of the scientific disciplines, their practice of creative thinking, and the application of judgment with a minimum of emotion. These qualities make them highly qualified to tackle some of the educational and social problems that technology creates. And, along with all other people of other vocational interests, it is their responsibility to do so.

Our science and engineering can create the tranquilizers, but our responsibility goes further than that. We must do what we can to eliminate the need for tranquilizers.

Nuclear Scientists Will Be Needed

A survey by the Atomic Industrial Forum, Inc., of New York, for the U. S. Atomic Energy Commission, was published in October under the title: "Scientific and Engineering Manpower Requirements for the Atomic Industry." It estimates that some 7,500 scientists and engineers were employed in September, 1956, in all types of atomic energy activity supported by private industry. For July, 1957, it estimated that approximately 9,000 were employed. In concludes that "there does not now appear to be a critical shortage of scientists and engineers for privately supported atomic energy work", but that by 1960, the demand is expected to increase to an estimated 16,000.

Appointed, John L. Miller as sales manager of Scientific Glass Apparatus Co., Inc., Bloomfield, N. J.

Applications: For Science Fellowships are invited by the National Science Foundation. Applications for the graduate and postdoctoral fellowship program may be obtained from the Fellowship Office, National Academy of Sciences-National Research Council, 2101 Constitution Ave., N. W., Washington 25, D. C. Applications for senior postdoctoral and science faculty fellowships may be obtained from the Division of Scientific Personnel and Education, National Science Foundation, Washington 25, D. C.

The Challenge Ahead

Dr. P. Victor Peterson

President, Long Beach State College, Long Beach, California

(Presented at the Western AIC Chapter's Student Medal Award Meeting.)

WE LIVE in the greatest period of scientific expansion that this civilization has ever known. The next twenty-five years will, if we can maintain our social and political equilibrium, produce the greatest development in terms of productivity that the world has yet experienced.

I recall some of the developments that have come about during the lifetime of the present generation. My freshman chemistry teacher once told us that metallic magnesium would never have any commercial value—it was too soft and too active chemically. Yet it is rapidly becoming one of our important metals and before long its alloys may largely replace steel in building and machine industries. Nylon only a few years ago was a curiosity. Yet synthetic fabrics have materially supplanted those of natural origin. Plastics are in evidence everywhere. We may have completely non-breakable plastic automobile bodies in the next few years.

It seems only yesterday that the clumsy two-cylinder horseless carriage made its appearance. World War I gave the first real impetus to the airplane. In less than one lifetime, from these crude beginnings, chemistry and engineering have built speed and comfort into modern transportation beyond the dream of man fifty years ago. We board a plane in London and within 12 hours of luxurious travel, we are in New York. Compare this to the twelve to sixteen weeks' journey in a small sailboat—the only means by which our forefathers could cross the Atlantic. Or contrast the comfort of the modern ocean liner, with steerage travel of a century ago in which 100 to 150 men, women, and children ate and slept in one large hot or cold, unventilated room, followed by a slow train or stage ride to their destination somewhere in the wild wilderness beyond the Atlantic shores.

No wonder we refer to those early pioneers as men and women with real courage, conviction and character. As one flies over that same land route today and looks down on what was then an uncharted terrain with vast plains, deserts, forests, lakes, rivers, and mountains; as one stands at the top of the Donner Summit and looks eastward across that impenetrable mass of broken granite, or as one approaches Death Valley from Furnace Creek Wash and suddenly is faced with that endless waste consisting of myriads of razor-sharp projections of nearly pure salt; one can but wonder what gave those brave souls the courage to continue on towards their unknown destiny. Modern science has eliminated most of the discomforts

associated with early travel.

The development in transportation which lies behind us is only the beginning, if we but listen to the reports of modern engineering. It is not beyond the realm of possibility that some in this generation may visit the moon. Oil and coal will certainly lose their supremacy as transportation fuels.

In the field of medicine, the antibiotics have eliminated the scourge of many diseases which formerly took a terrific toll of human lives. The use of vitamins and special diets are no longer restricted to humans, and livestock is controlled by scientific breeding. Agricultural yields have been increased tremendously by scientific experimentation. We will ed to push productive agriculture even further to feed and clothe the anticipated population of the world within the next century.

We live in a push-button age. We can push a button to hear, and see, the great Philadelphia Philharmonic Orchestra. . . . Never has good music and entertainment been so close at hand. Gadgets and push-buttons are everywhere. Never in the history of man has he had the comforts and conveniences which, through scientific efforts, are now available to him. However, our major concern is, has man learned how to use these discoveries for the good of all mankind, or has he become so independent of his fellow man that he no longer has concern for their welfare?

Much in the world must of necessity disturb us. Social and political progress has not kept pace with scientific development. A British statesman some years ago was reported to have arisen in Parliament, and after making an impassionate speech extolling the accomplishments of British scientists, then made a motion that Parliament pension all scientists and give them a ten-year vacation, in order to let society catch up!

Seriously, we must learn to use our scientific discoveries and developments for the benefit of mankind, or know that the potential destructive power placed in the hands of an irresponsible individual could wipe out our civilization. I have no thought that this will happen, though I am disturbed by the lack of intelligent attention given to study of the social sciences. I do not want to reduce our efforts in the field of pure science, but I hope that as we progress in our knowledge and control of the physical world, we will make similar progress in our un-

derstanding of the social forces, which in the end will determine the destinies of man.

As we extend the span of life, I hope we can put more time into the preparation of this longer period of service. My final word to young people would be that you give serious consideration to the breadth, as well as the depth, of your professional preparation.

The outside world is ready to welcome you. The decision which you must make is, are you ready, in terms of training and maturity, to most effectively meet the challenge which lies ahead? Do you have all of the training necessary to take full advantage of your capacity? There never has been a time when competition has required as much, in terms of brain power productivity, as it does today. Every producer must provide himself with all of the tools which he can effectively use. Do not handicap yourself by going on to a job only partially prepared. Your employer will never excuse inability to cope with an assigned responsibility.

Get all the training which you are capable of absorbing—making certain that it is broad as well as deep. Find the kind of employment environment in which you will enjoy working, maintain the high ideals which your mother taught you, establish a happy home, give your employer your best effort, allow the proper time for leisure and recreation, be a good citizen, enjoy your friends. These are best recipes that I know for a successful life.

Moved: R. S. Aries & Associates to new and larger quarters in Stamford, Conn., at 77 South Street.

New Trade Mark: For Diamond Alkali Company, Cleveland 14, Ohio. The "Chemical Diamond" is vertically centered within a calligraphic letter "d", which also suggests a chemical retort.

Moved: The Oscar Fisher Co., Inc., from Peekskill, N. Y., to Newburgh, N. Y.

Correction

To the Secretary:

In the October issue of THE CHEMIST, on page 402, there is an item which states that I am director of chemical research, Research Division, Armour and Company. This should be corrected to: Director of Research, Research Division, Armour and Company.

—Dr. John A. King
Chicago 9, Illinois

Understanding the Creative Process

Dr. Maurice J. Kelley, F.A.I.C.

Director, Industrial Specialties Laboratories, Nopco Chemical Co., Harrison, N. J.

(This is Part II of a series which started in the November, 1957, CHEMIST)

Part II. The Thinking Processes and Creativity

The Powers of the Mind

IN ORDER to understand the creative process, it is necessary to know something about the human mind and especially about the thinking processes. The faculties of the mind are shown in Table 1, and the three faculties in italics are those of greatest importance to creativity: Imagination to feed ideas, Intellect to restrain its judicial powers and supply insight, and the will to strive mightily for our objective.

Table 1. Faculties of the Mind

Cognitive

Sensuous
- External Senses
- Internal Senses: Common Sense, *Imagination,* Sensory Memory, Instinct

Rational
- *Intellect*

Appetitive

Sensuous
- Impulses, Desires
- Feelings, Emotions

Rational
- *Will*

Common sense unifies all perceptions into a harmonious whole, and causes us to question that which is at variance with the whole. Imagination is the power to retain, reproduce and construct images of absent objects. Sensory Memory is the power to retain, reproduce and recognize past experiences. Instinct is the sense to know what is useful or harmful to the individual or species.

Thinking is the Intellect in action; it is the power of the mind by which it reflects on itself and on what it is doing or sensing. Some of these actions, psychologists tell us, are those shown in Table 2, which also describes each function.

Table 2.
The Thinking Powers—Intellect

1. **Cognition:** awareness of things; giving attention to
2. **Conception:** abstracting the essense from sensuous experiences, to form ideas
3. **Judgment:** Speculative: Combining ideas into more complex ones (synthetic)
   Resolving the complex into simpler parts (Analytic)
   Practical: Comparing; asserting conformity or non-conformity of two ideas
4. **Reasoning** (Logical Thinking): Deriving new judgments from other judgments already known
   Induction: Extracts principles from individual cases
   Deduction: Infers particulars from known principles
5. **Intuition** (Insight): Obtaining knowledge without the need of judgment or reason
   Inspiration: Insight obtained while thinking
   Illumination: Insight obtained while not thinking

While all these powers contribute to creativity, the first four: Cognition, Conception, Judgment, and Reason-

ing are not in themselves creative. Their excessive strength, or use at the wrong time, can be very detrimental to creativity. Only intuition or insight is inherently creative. Intuition is the highest function of the Intellect, and is defined as the obtaining of knowledge without the need or use of judgment or reason. It is the way God knows things. No wonder it can produce such amazing results, and that one must rise above the ordinary level in order to obtain insight.

Thus we see that Imagination and Intuition are the quintessence of creativity. Yet, in most people, imaginings are wasted on unimportant and non-creative matters and Intuition is relatively rare and little understood. Thus, creativeness and intelligence are two quite distinct mental capacities. Intelligence is measured by the completeness with which the whole can be mentally grasped.[1], whereas creativeness is measured by the originality which can be projected out into the material world.

Creative and Non-Creative Thinking

It is a fact that areas of creativity vary in different people; some are creative in mechanical fields, others in the arts, some in organizing ability, and so on. Occasionally, the world beholds a many-sided creative genius like Aristotle, Leonardo da Vinci, Francis Bacon, and Albert Schweitzer.

The creative problem has no single, correct answer as an analytical problem has. The creative problem has many approaches and many solutions, some better than others, and always a better one remains for the future to discover. On the other hand, the analytical problem has one answer only, arrived at by logical thinking, mathematics, or experiment.

Prof. Arnold[2] describes two types of creativity based upon the type of approach to the creative problem:

(1) **Organized approach; step by step from problem or need to a solution. This is the kind of creative work that exists in most present day research.**

(2) **Inspired approach, starts by dreaming the biggest dream possible, and thinking the biggest thought possible, and then devoting all one's energies to making that dream come true. This is more difficult and more demanding, but yields greater progress. The greats of history had this approach, and many of them spent or gave their lives for their dreams.**

Reflective, logical or non-creative thinking can be superficial, stop-start, and can concern itself a great deal with techniques[3]. Creative thinking is dynamic, all-absorbing, and runs its course. Table 3 lists some of the attributes and tools[4] of creative think-

1. Von Fange, E. K. "Understanding the Creative Process." Gen. Elec. Rev. **58**, 54-7 (July) 1955.

2. Arnold, John E. "Creativity in Engineering." S.A.E. Trans. **64**, 17-23, 1956.

3. Flory, Charles D. "Developing and Using Our Creative Abilities". Chem. Eng. Prog. **49**, 676-8, 1953.

4. Easton, William H. "Creative Thinking and How to Develop It". Mech. Eng. **68**, 647. (Aug.) 1946.

ing, and shows how these contrast with those of non-creative thinking.

Table 3.

Non-Creative Thinking	*Creative Thinking*	
	Attributes:	
voluntary	spontaneous	
focalized	often vague	
stop-start	tied to mood, even to place	
often boring	absorbing in itself	
conforming	unconventional	
not lost easily	lost rapidly by misuse, neglect	
	Tools:	
Observation		
reflection	imagination	insight
remembering	inspiration	insight
judgment	illumination	insight
reasoning		

The creative thinker is not necessarily more intelligent than other people, but he has a special temperament which causes him to use the creative tools purposefully and more often. When the non-creative thinker does use these tools, he uses them mainly in day-dreaming, worrying, and escaping trouble.

The creative person has more ideas per unit time than does the non-creative person. The creative person is better able to willfully suspend judgment, and he has fewer blocks to the full utilization of his subconscious mind.[2] The creative person can jump from one approach to another, from one field to another, without losing sight of the goal. He knows when to abandon false leads. He is venturesome, and thinks beyond and ahead of his colleagues. He is sensitive to the existence of problems even before they are stated, and perceptive of clues, hunches and all stimuli. He tries new paths, also makes them[3].

Some of these and other attributes of the creative person, and their counterparts in the non-creative person, are contasted in Table 4, according to A. H. Maslow[5].

Table 4.

Non-Creative Person	*Creative Person*
means-centered	problem-centered
methodologist	question-asker
how a problem is solved	what problem should be solved
seeks quantitative facts	seeks relative results
fits problem to technique	finds new techniques
divides activities by function	says "Get out of my way"
concentrates on differences in people	concentrates on similarities of people
a "safe" settler	a "daring" pioneer

Arnold [2] says the creative person

5. Maslow, A. H. "Problem-Centering vs. Means-Centering in Science." Phil. Sc. **13**, 326-31, 1946.

is able to apply "multi-path low probability" thinking. The same author points out some seeming contradictions in the makeup of a creative person:

HE	YET
seeks the most accurate statement of the problem	is more tolerant of ambiguity
questioning everything	believes anything is possible
cannot be happy (in doing productive work)	without being unhappy (in extremely frustrating conditions)

The thinking processes themselves continue to be the object of much study by scientist-psychologists. One of the most famous and thorough studies is that under the direction of Dr. J. Paul Guilford, of the University of Southern California, and a former president of the American Psychological Association. He has been conducting, since 1949 under the sponsorship of the Office of Naval Research, an extensive study of the thought processes under the categories of analytical thinking, judicial thinking, and creative thinking.

(Part III, Who is Creative and Why?, will appear in the January issue of The Chemist.)

Opportunities

Doris Eager, M.A.I.C.

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AIC Activities

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Management-Technical Employee Relationships

The New Jersey Chapter will meet on Jan. 7, 1958, at the Military Park Hotel, Newark, N. J. The subject will be "Management-Technical Employee Relationships." The men who will present management's views are: Dr. William H. Lycan of Johnson & Johnson; Dr. Stanley O. Morgan of Bell Telephone Labs., and Dr. Max Tishler of Merck & Co., Inc.

Those representing the viewpoint of technical personnel will be: Paul O. Blackmore of Interchemical Corp.; Dr. H. Herbert Fox of Hoffman-La

Roche, Inc., and Albert Gessler of Esso Research Labs. Dr. Allan R. A. Beeber, Keuffel & Esser Co., chairman of the Chapter's program committee, will act as moderator.

Dinner is at 6:30 p.m.; meeting, 8:00 p.m. For dinner reservations ($4.25 including gratuities): Dr. J. F. Mahoney, Merck & Co., Inc., Rahway, N. J. Telephone FUlton 8-1200, ext. 3254.

Washington Chapter

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Research at the Geophysical Laboratory

Dr. Philip Abelson, director, Geophysical Laboratory, Carnegie Institution of Washington, addressed the Washington Chapter at its October 8th meeting. He discussed the administration and research program of the Laboratory; traced some of the history of the organization and geophysics, its general scope, special interest in high pressure work, and work in related fields abroad. The discussion also touched on the current scientific work in the USSR. Evaluations of the scientific work in certain fields point to USSR concentration of effort which exceeds by a significant margin similar work in this country.

Committees

The Washington Chapter has appointed the following committees: *Program and Orientation*: Anthony Schwartz, chairman; John G. Fletcher, Richard Kenyon, Louis Mizell. *Membership*: Robert C. Watson, chairman; T. Allen Davis, John G. Fletcher, Joseph A. Noone. *Awards*: Maynard Pro, chairman; Madeline Berry, Elizabeth Hewston, Louis Markwood. *Legislation & Standards*: Paul E. Reichardt, chairman; Fred S. Magnusson, Alexander P. Mathers, Albert F. Parks. *Chapter Analysis*: Charles B. Broeg, chairman; A. D. Etienne, Arthur Schroder, Frank Wilder.

For Your Library

Organo-Metallic Compounds

By G. E. Coates. John Wiley & Sons, Inc., 1956. 197 *pp.* 7½"x5". $2.50.

This interesting volume reviews organic-metallic compounds containing metal-carbon bonds. Excluded are compounds in which metal atoms are bonded to organic systems generally via oxygen, nitrogen or sulphur, and the compounds of silicon, phosphorus and arsenic. This, however, does not impair the value of the book since the omitted compounds have been adequately covered in other monographs.

—Dr. Henry Tauber, F.A.I.C.

Chemical Books Abroad

By Dr. Rudolph Seiden, F.A.I.C.

Verlag Dr. Dietrich Steinkopff, Darmstadt: *Einfuehrung in die Ultrarotspektroskopie,* by W. Bruegel; 2nd ed., 404 pp. (166 ill.); paperbound DM 49—An introduction to ultrared spectroscopy—its theory, laboratory equipment, preparative techniques, and practical applications in research and industry.

Georg Thieme, Leipzig C 1: *Pharmakologie und Grundlagen der Toxikologie,* by F. Hauschild; 1956, 1124 pp. (170 ill., 312 tables); DM 46.80—A well-planned textbook of pharmacology and toxicology which, in addition to established facts and recent advances in the relation of these sciences to the treatment of diseases, considers also findings explained by different authors in contradictory manner. Indexes and literature references fill 60 pp. • *Antikoagulantien,* by E. Perlick; 1957, 304 pp.; DM 36—Anticoagulants often play a life-saving role in modern medicine. This volume represents a splendid compilation of all that is known today about physiology of blood coagulation, pharmacology of the many anticoagulants developed into safe and effective therapeutic agents in recent years, as well as indications and precautions for their use.

Fachbuchverlag, Leipzig W 31: *Chemie im Molkereifach,* by Marianne Zuehlsdorf; 1957, 137 pp. (36 ill.); DM 6.80—This volume presents in simple language all the important facts about the chemistry of milk and other dairy products; it also concisely describes simple procedures for their analysis.

Karl F. Haug Verlag, Ulm/Donau: *Chinesisch-Tibetische Pharmakologie und Rezeptur,* by F. Huebotter; 1957, 180 pp. (45 ill.); DM 18—An expert with 30 years of experience in the Far East is convinced that many of the natural drugs used since ancient times are effective. He describes hundreds of them and gives formulations in detail, some of which may be of interest to pharmacologists and antibiotic researchers.

Verlag Technik, Berlin W 8: *Ueber die Entstehung der chemischen Strukturlehre,* by W. N. Dawydoff; 1957, 108 pp.; DM 9—The development of our knowledge of structural chemistry is here depicted—from Berzelius and Gerhardt to Kolbe and Frankland. Special emphasis has been given to the (in Western countries) so little known works of the Russian A. M. Butlerow and his school.

Dr. Alfred Huethig Verlag, Heidelberg: *Internationaler Reichstoff-Kodex,* 1. *Ergaenzungsband,* by A. Mueller; 1957, 315 pp.; DM 28.—The 1st supplement to this

encyclopedia of ethereal oils (reviewed in the February 1953 issue of THE CHEMIST) contains useful chemical, physical, and other pertinent data for newer synthetic perfumes, perfume bases, fixatives, and solvents. It lists also trade names and manufacturers from all over the world.

About AIC Members

Dr. Frederick G. Sawyer, F.A.I.C., has been appointed vice president of Jacobs Engineering Co., Pasadena, California.

Dr. Robert Ginell, F.A.I.C., was promoted recently to associate professor of chemistry at Brooklyn College, Brooklyn 10, N. Y.

Dr. Ray P. Dinsmore, Hon. AIC, and **Lawrence Flett,** F.A.I.C., have returned from participating in the American Day program of the 30th Congres of the Societe de Chimie Industrielle at Athens, Greece, in September. Following the meeting, Mr. Flett made a study of a number of research laboratories in Europe. He was much impressed by the dedication of the chemists to basic research, the high ideals of the directors, and the wonderful equipment.

Dr. Thomas H. Vaughn, F.A.I.C., vice president for corporate development of Pabst Brewing Co., has been elected president of Industrial Research Institute, 100 Park Ave., New York 17, N. Y.

Philip P. Gray, F.A.I.C., is now vice president of Wallerstein Company, Inc., New York, N. Y.

John S. Shanly, M.A.I.C., has joined the research staff of Houghton Laboratories, Inc., Olean, N. Y.

Dr. John A. Yourtee, F.A.I.C., technical superintendent, Marcus Hook cellophane plant, Film Division, American Viscose Corp., announces that M. K. Barrall and W. F. Mount have been appointed technical control supervisors.

W. Alec Jordan, F.A.I.C., announces that John J. Craig joined W. Alec Jordan Associates, 52 Park Ave., New York, N. Y., as vice president.

Gilbert J. Straub, F.A.I.C., is now with the Baxter Laboratories, Inc., 6301 Lincoln Ave., Morton Grove, Illinois.

Dr. W. A. Raimond, F.A.I.C., has been named technical director of the Engineering and Construction Division of American Cyanamid Co., New York 20, N. Y.

O. T. Aepli, F.A.I.C., was promoted recently to head of the Analytical Section of Pennsalt Chemicals Corp., Industrial Division, Wyandotte, Michigan.

Benjamin Sweedler, F.A.I.C., and Milton Zucker announce that their law practice will continue under the firm name, Sweedler and Zucker, at 420 Lexington Ave., New York 17, N. Y.

Dr. E. M. Kipp, F.A.I.C., director of research, Foote Mineral Co., Philadelphia 44, Pa., announces that **Dr. Alexander Silverman,** Hon. AIC, has been retained as special consultant to the company on its research program in the use of lithium in inorganic chemistry and glass technology.

Dr. Jack T. Thurston, F.A.I.C., is assistant general manager, Phosphates and Nitrogen Division, American Cyanamid Co., New York 20, N. Y.

George F. Sharrard, F.A.I.C., is with the Marketing Research Department of Wyandotte Chemicals Corporation, Wyandotte, Michigan.

Hillary Robinette, Jr., F.A.I.C., announces that Clair A. Lippincott, medical laboratory specialist, has joined the staff of Robinette Research Labs., Inc., Ardmore, Pa.

Dr. John S. Rovey, F.A.I.C., is vice president of Labglass, Inc., and Lab Research Manufacturing Co., North West Blvd., Vineland, N. J.

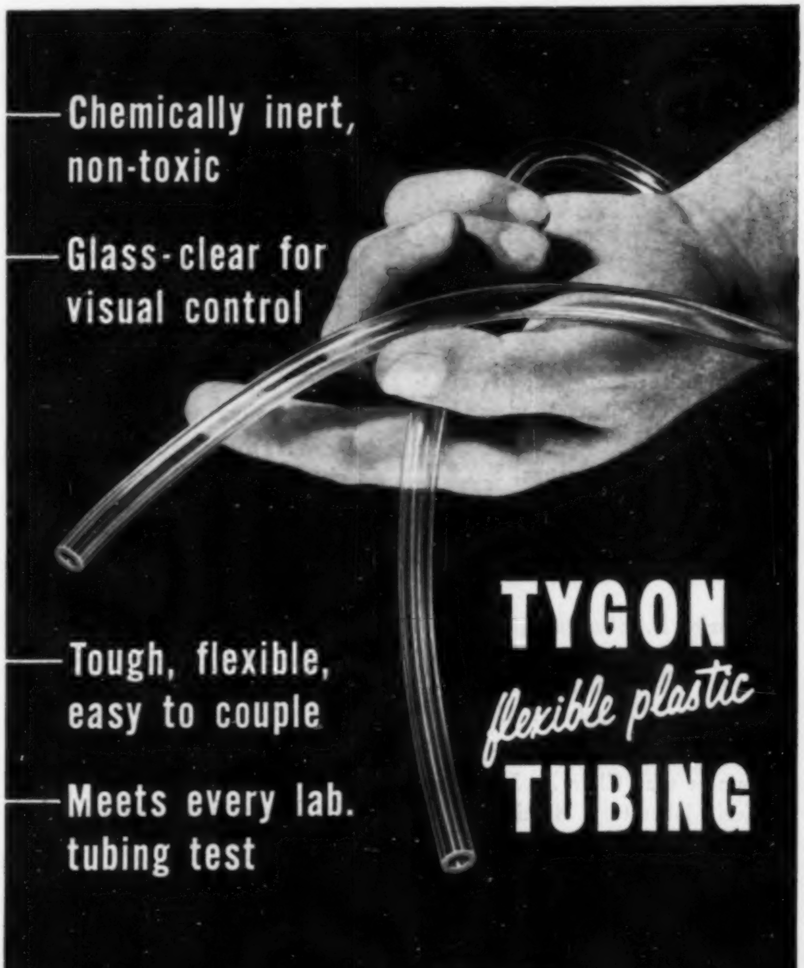
Dr. Oswald U. Anders, A.A.I.C., is now in the Radiochemistry Laboratory of the Dow Chemical Company, Midland, Michigan.

Robert A. Stauffer, F.A.I.C., vice president, National Research Corporation, Cambridge 42, Mass., announces that John S. Light has joined the firm as director of the Mechanical Engineering Department.

D. W. Young, F.A.I.C. research associate, Sinclair Research Laboratories, Inc., Harvey, Illinois, is serving on the Education Committee of the American Chemical Society for 1957-1958.

W. Kenneth Menke, F.A.I.C., vice president of Pittsburgh Coke & Chemical Co., announces that the assets of the Insul-Mastic companies of Summit, Ill., have been purchased by the Pittsburgh company.

Dr. James B. Conant, F.A.I.C., is now located at 588 Fifth Ave., New York 36, N. Y.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